

Remarks

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and the following remarks. Claims 1, 3-16, 18, and 21-22 are pending. Claims 1, 11, and 15 are independent. No claims have been allowed. Claims 1, and 3-22 are rejected. Claims 2, 17, 19, 20, and 22 are canceled without prejudice. Claims 23 and 24 are new. These rejections are respectfully traversed. Claims have been amended, all for reasons not necessarily related to patentability. The amendments herein do not necessarily narrow the claims. No new matter has been added.

Claim Rejections under 35 U.S.C. § 101

The Action rejects claims 1 and 3-22 under 35 U.S.C. § 101 as being directed to non-statutory subject matter. These rejections are respectfully traversed.

1. The Actions rejects Claims 1, 3-24, and 21-22 as reciting a computer program product as well as a method.

However, the claim is more properly characterized as a computer readable medium claim, which is allowable, as shown in the MPEP, section 2106.01, and quoted below.

"[F]unctional descriptive material" consists of data structures and computer programs which impart functionality when employed as a computer component. (The definition of "data structure" is "a physical or logical relationship among data elements, designed to support specific data manipulation functions." ... When functional descriptive material is recorded on some computer-readable medium, it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized.

Claim 1 reads

1. A computer program product embodied on a first computer-readable medium and comprising code that, when executed, causes a computer to perform a method of generating a partial procedure summary of a procedure of multithreaded software, wherein the procedure performs a plurality of actions when executed, the method comprising:
performing a reachability analysis of at least a portion of the multithreaded software;

when the procedure is reached during the reachability analysis.

1) identifying a plurality of the actions as atomically modelable with respect to multithreaded execution of the procedure as atomically modelable actions; and

2) generating the partial procedure summary of the procedure from the plurality of the atomically modelable actions, wherein the partial procedure summary comprises at least one state pair, wherein the at least one state pair models an initial state and a resulting state of an atomically modelable action for the procedure;

the reachability analysis consulting the partial procedure summary to continue the reachability analysis.

[Emphasis added.]

As quoted above, “[t]he definition of ‘data structure’ is ‘a physical or logical relationship among data elements, designed to support specific data manipulation functions.’” [MPEP, section 2106.01.]

For purposes of 35 U.S.C. §101 analysis, claim 1 describes data structures, as claim 1 describes physical or logical relationships, e.g., “performing... identifying... generating... consulting...” The claim 1 language also discusses data elements, e.g., multithreaded software, atomically modelable actions, state pairs, and so forth. Thus, claim 1 comprises function descriptive material, as it describes “a physical or logical relationship among data elements.” [Id.]

Further, “[w]hen functional descriptive material is recorded on some computer-readable medium, it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized.” [Id.] Claim 1 records function descriptive material (e.g., “comprising *code*”) on a computer-readable medium (e.g., “a first *computer-readable medium*) in which the function of the descriptive material is realized (e.g., “comprising code that *when executed*, causes a computer to perform a method of ...”).

Therefore, claim 1 is directed towards statutory subject matter. Applicant respectfully requests withdrawal of this rejection. Claims 3-10 and 21 are dependent upon statutory claim 1, and so should be statutory for at least that reason.

2. The Action rejects claims 15-18 for reciting a computer program product as well as a system. Claim 15 has been amended to recite: “A computer-implemented system.” Similar

amendments have been made to the dependent claims 16 and 18. Accordingly, Applicants respectfully submit that the 35 U.S.C. § 101 rejections of claims 15, 16 and 18 should be withdrawn.

3. The Action rejects claims 19 and 20 on the grounds that they explicitly state software elements as well as data structures. This rejection is moot, as these claims have been canceled.

Cited Art

Tyrrell *et al.*, “CSP Methods for Identifying Atomic Actions in the Design of Fault Tolerant Concurrent Systems” (hereinafter Tyrrell).

Patentability of Claims 1, 3-18, and 21-22 over Tyrrell under 35 U.S.C. § 102(b)

The Action rejects claims 1 and 3-22 under 35 U.S.C. § 102(b) as being anticipated by Tyrrell. These rejections are respectfully traversed. Applicants respectfully submit that the claims in their present form are allowable over the cited art. For a 102(b) rejection to be proper, the cited art must show each and every element as set forth in a claim. [See MPEP § 2131.] However, the cited art does not so show. For example, with respect to claim 1, Tyrrell does not show:

*performing a reachability analysis of at least a portion of the
multithreaded software;
when the procedure is reached during the reachability analysis,
1) identifying a plurality of the actions as atomically modelable with
respect to multithreaded execution of the procedure as atomically modelable
actions...*

Claims 1, 3-10, and 21.

Claim 1 recites:

1. A computer program product embodied on a first computer-readable medium and comprising code that, when executed, causes a computer to perform a method of generating a partial procedure summary of a procedure of multithreaded software, wherein the procedure performs a plurality of actions when executed, the method comprising:
performing a reachability analysis of at least a portion of the multithreaded software;
when the procedure is reached during the reachability analysis,

- 1) identifying a plurality of the actions as atomically modelable with respect to multithreaded execution of the procedure as atomically modelable actions; and
- 2) generating the partial procedure summary of the procedure from the plurality of the atomically modelable actions, wherein the partial procedure summary comprises at least one state pair, wherein the at least one state pair models an initial state and a resulting state of an atomically modelable action for the procedure;
the reachability analysis consulting the partial procedure summary to continue the reachability analysis.
[Emphasis added.]

For example, the amendments, above, are supported in the Specification and Figures at, e.g., p. 8, line 20 to page 9, line 5; page 11, lines 8-21, and page 13, lines 1-29.

performing a reachability analysis of at least a portion of the multithreaded software;
when the procedure is reached during the reachability analysis, 1)
identifying a plurality of the actions as atomically modelable with respect to multithreaded execution of the procedure as atomically modelable actions....

In Tyrrell, a reachability analysis is performed, but “the system is designed using the requirement specification and modeled as a petri net.” Then “examination of the state reachability graph permits the designer to identify the boundaries of atomic actions.” [Tyrrell, page 631, left col., first two sentences..]

This is a vastly different sort of reachability analysis than that found in amended claim 1. For example, in Tyrrell, the *entire* reachability analysis is performed first, creating a reachability graph. [Id.] Only then does the designer identify the boundaries of atomic actions. [Id.]

In claim 1, “when the procedure is reached during the reachability analysis” then “a plurality of actions” are identified as “atomically modelable.” Tyrrell teaches against this in two ways. First, the Tyrrell reachability graph being completely created prior to analysis of the graph teaches against identifying actions as atomically modelable in the middle of the reachability analysis. Second, in Tyrrell, the reachability analysis is performed on a *state* reachability graph, (“[e]xamination of the *state reachability graph* permits the designer to identify the boundaries of atomic actions.” [Tyrrell, page 631, left col., first two sentences, emphasis added.]) teaching away from a reachability analysis with special actions for *procedures*, or indeed, any programming constructs above the state level. Thus Tyrrell teaches away from the claim 1 language *performing a reachability analysis of at least a portion of the multithreaded software*;

when the procedure is reached during the reachability analysis, 1) identifying a plurality of the actions as atomically modelable with respect to multithreaded execution of the procedure as atomically modelable actions....

Applicants also fail to see how the brief discussion of reachability analysis found in Tyrrell would lead one of ordinary skill in the art to the claimed arrangement, which involves *performing a reachability analysis ...; when the procedure is reached during the reachability analysis, 1) identifying a plurality of the actions ... as atomically modelable actions...* as recited in claim 1.

Since the cited reference does not show all of the elements recited in claim 1, Applicants believe the claim is not subject to a 102(b) rejection and request the rejection be withdrawn.

Thus, Applicants respectfully submit that claim 1 and its dependent claims 3-10, 21, and 23-24 are allowable over the cited art.

Claims 11-14

Claim 11 is directed to a computer program product embodied on a first computer-readable medium and comprising code that, when executed, causes a computer to perform a method of modeling multithreaded software, and recites:

11. A computer program product embodied on a first computer-readable medium and comprising code that, when executed, causes a computer to perform a method of modeling multithreaded software, the method comprising:
performing a reachability analysis of the multithreaded software;
during the reachability analysis, reaching a procedure;
analyzing actions of the multithreaded software within the procedure such that actions that can be executable atomically are determined; and
based on the analyzing, generating a plurality of procedure summaries for the multithreaded software, the plurality of procedure summaries comprising
respective start and end actions for the determined actions executable atomically;
and
during the reachability analysis, again reaching the procedure and reusing the plurality of procedure summaries to determine actions executable atomically;
wherein the procedure summaries comprises a plurality of modeled states of the multithreaded software for multithreaded execution of the multithreaded software.
[Emphasis added.]

Not to belabor the point, but using the analysis shown in claim 1, it can be seen that Tyrrell does not teach or suggest all of the elements recited in claim 11.

Further, even if, for argument's sake, Tyrrell were to be seen as describing procedure summaries, Tyrrell does not teach or suggest reusing procedure summaries and so does not teach or suggest the claim 11 language "during the reachability analysis, again reaching the procedure and reusing the plurality of procedure summaries to determine actions executable atomically..."

Since the cited reference does not show all of the elements recited in claim 11, Applicants believe the claim is not subject to a 102(b) rejection and request the rejection be withdrawn.

Thus, Applicants respectfully submit that claim 11 and its dependent claims 12-14 are allowable over the cited art.

Claims 15, 16, and 18

Claim 15 is directed to a computer system for modeling multithreaded software, and recites:

15. A computer-implemented system for modeling multithreaded software, the system comprising:
a model checker operable to analyze a model of the multithreaded software via checking the model of the multithreaded software for programming flaws, the model checker comprising:
the model of the multithreaded software,
wherein the model comprises;
a plurality of procedure summaries modeling states of the multithreaded software during multithreaded execution of the multithreaded software, the procedure summaries comprising the start and end states of sets of actions atomically modelable with respect to multithreaded execution of the software; and
a reachability analyzer operable to employ the procedure summaries instead of the sets of actions to generate modeled states of the software.

[Emphasis added.]

Not to belabor the point, but using the analysis shown in claim 1, it can be seen that Tyrrell does not teach or suggest all of the elements recited in claim 15.

Since the cited reference does not show all of the elements recited in claim 15, Applicants believe the claim is not subject to a 102(b) rejection and request the rejection be withdrawn.

Thus, Applicants respectfully submit that claim 15 and its dependent claims 16 and 18 are allowable over the cited art.

Support for Amendments and New Claims

Support for the amendments and new claims can be found in the Specification and Figures as originally filed. In addition, the following examples of support are given:

Specification, page 12, lines 25-27;

Specification, page 20, lines 14-16;

Specification, page 37, lines 17-21.

Request for Interview

If any issues remain, the Examiner is formally requested to contact the undersigned attorney prior to issuance of the next Office Action in order to arrange a telephonic interview. It is believed that a brief discussion of the merits of the present application may expedite prosecution. Applicants submit the foregoing formal Amendment so that the Examiner may fully evaluate Applicants' position, thereby enabling the interview to be more focused.

This request is being submitted under MPEP § 713.01, which indicates that an interview may be arranged in advance by a written request.

Conclusion

The claims in their present form should now be allowable. Such action is respectfully requested.

Respectfully submitted,

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